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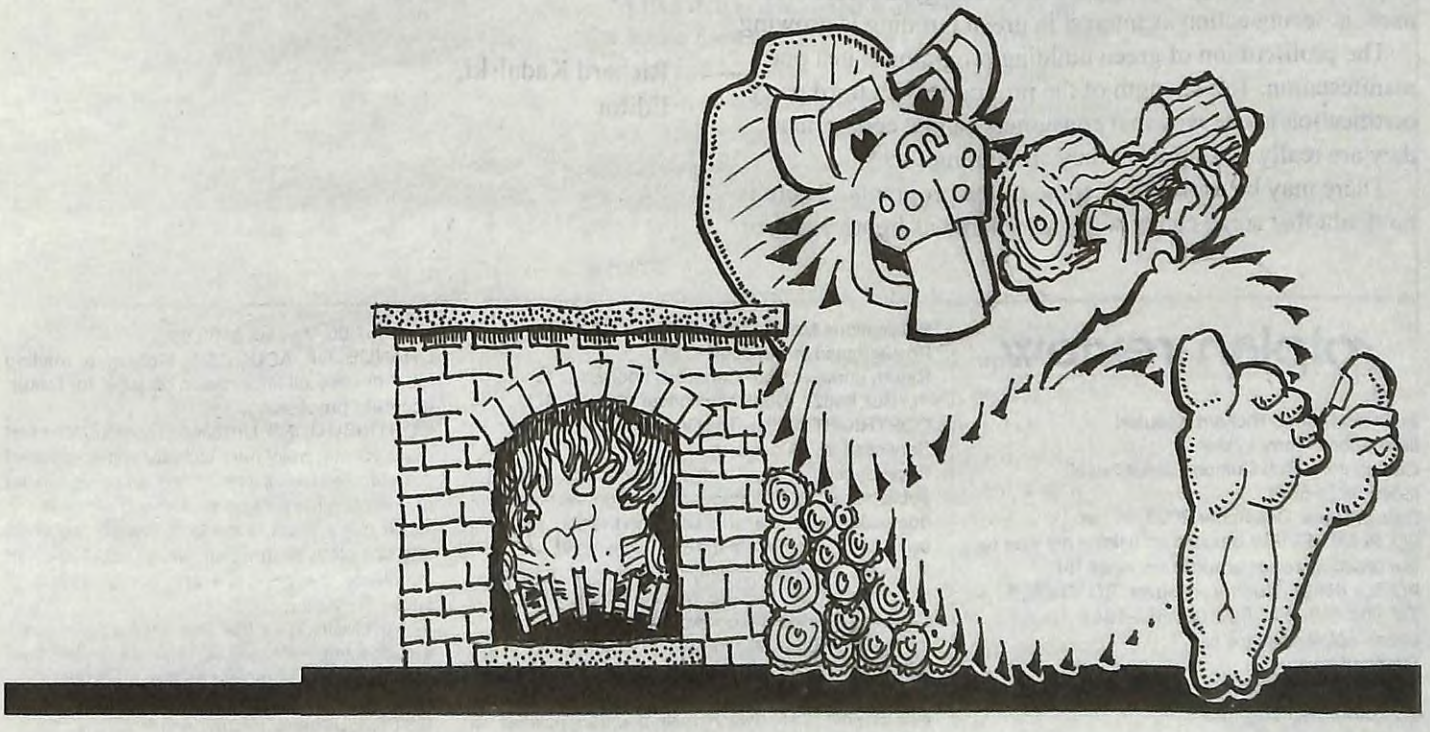
# Fireplaces: Energy Efficient Heating Devices?



# From the Editor . . .

Despite the efforts of some that are trying to sow doubt about human impact on climate change, there is no doubt that the earth's climate is changing, and changing fast. The conventional energy sector (especially oil and gas) seems to have taken a lesson from the tobacco industry to generate doubt and suppress information about the harmful effects of their product. The energy folks and their associates insist on ever more study even after conclusive evidence has been documented that human activity is having a detrimental impact on the earth's eco system.

Vast sums of money are keeping an army of consultants and public relations types busy –it may good for the consultants but bad for public policy. The hired guns are sowing doubt and trying to keep evidence under wraps, or at least under piles of goblygook. They are good enough that politicians are afraid of being honest, afraid of taking real action that needs to be taken.

Even though we may be snowed under by the blizzard of nonsense from those in denial, at least the insurance industry and the military around the world have become aware of the situation – since they are on the front lines of the consequences as devastating climatic changes – be it through storm surges, collapse of agriculture or other public disturbances.

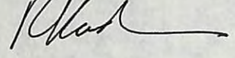
Fortunately, despite the inaction on the part of the policy makers, there seems to be a surge of interest in action to curb the environmentally damaging excesses. The building sector, responsible for a significant portion of energy and resource used, is seeing action as interest in green building is growing.

The proliferation of green building programs is just one manifestation. The strength of the programs with third party certification is one way that consumers can be certain that they are really getting what they are hoping for.

There may be criticism of some of the programs. There is no doubt that some can now be considered as lightweight, or even 'greenwash', but they do point to the increased level of interest. Good programs undergo periodic updates, and should be moving to upgrade and make their technical standards more aggressive.

The interest can be seen in the attention that net-zero energy and Equilibrium demonstration projects are achieving. People want to do the right thing, and many are prepared to go a long way. At the same time, there is a lot of misunderstanding just what that may entail – that is why credible third party oversight or review is needed. We are finding that even seemingly stringent standards really don't amount to much unless they are properly implemented.

But we also need to admit that the vast major of buildings that will be occupied in 2050 and beyond have already been built. Significant environmental impacts can be achieved by making improvements to existing buildings and building systems. We need to seriously look at how we can retrofit the existing housing stock so that their impact is significantly reduced. Initiatives such as the ecoEnergy incentives help, but we probably need to get much more aggressive so that those who cannot afford even modest upgrades can be helped.



Richard Kadulski,
Editor

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# Fireplaces: Are They An Energy Efficient Heating Device?

A fireplace is a central feature in many homes that is a throwback to our ancestors who relied on it for warmth and utility. In a country with long cold winters, the warm glow of a fire is a visual feast, and has been relied on as a source of heat in the past.

Generally, a fireplace is not an efficient primary heating source, whether it be a wood-burning or gas-fired unit, although it could be a secondary heating source.

Conventional wood-burning fireplaces are neither an efficient nor effective heat source – they rarely provide much heat beyond the room they are situated in. In most cases, on cold winter days, the use of conventional fireplaces will actually result in increased fuel consumption for heating, contributing to an overall heat loss.

Their average energy efficiency contribution is between -10% and +10%. Most of the time they are a net energy drain, especially if they are placed on an exterior wall as has been the tradition, since the heat will radiate in one direction only. Fireplaces placed in the middle of a room have the advantage of radiating heat in 4 directions. By comparison, the gas and oil furnaces today operate at better than 80% efficiency.

A major reason for the poor performance is that in an open fire, large volumes of heated household air moves through the fireplace and up the chimney when a fire is blazing. This heated air is just being drawn out of the house, adding extra load on the home's heating system, while only a small amount of air is actually needed for combustion.

Most conventional wood fireplaces are hard to light, can be smoky, create cold, unpleasant drafts and can contaminate indoor air at both the beginning and end of the burn cycle. When a fire is first lit, if the chimney is not warm enough to draw the combustion products to the outdoors up the chimney, or if combustion air is not provided (such as an open window), much of the smoke and gases can spill back into the home. This is called combustion spillage, and can be dangerous.

In addition, as houses are becoming more airtight, the air that the fireplace pulls will take the easiest path, which is often down the flue of the furnace, or gas water heater flue or another fireplace in the house, drawing the combustion products from the furnace or water heater back into the home. This is called backdrafting, and can be dangerous if the furnace or domestic hot water heater starts up, because their exhaust fumes will come into the house.

In addition, at the end of the burn cycle, a wood fireplace can also be a major source of carbon monoxide (CO). As a fire burns down it emits significant amounts of CO. The dying fire also means that the chimney is cooling and will be less likely to draw the flue gases, including CO to the outdoors. This is especially the case for flues that are mostly outside the conditioned space of the house, such flues as those on an exterior wall. In these cases, the natural stack effect of the house may become a better chimney than the flue itself. In some cases, the dying fireplace flue gases may also be pulled back into the home if the furnace or water heater need air. In all these cases, there is a potential for CO poisoning of the occupants, which can and does cause deaths in Canada every year.

A flue that is contained within the centre of the house for a major portion of its height will be warmer and be better able to maintain a draft.

Advanced combustion fireplace inserts are one of a number of technologies that can dramatically improve the performance of a wood-burning fireplace, and reduce the amount of smoke and other pollutants that are produced by the burning of wood.

Advanced combustion technology was developed to reduce emissions from wood stoves. Advanced combustion fireplaces incorporate elements of wood stove technology, producing an attractive, safe, relatively efficient and cost-effective alternative to conventional site-built fireplaces. In these designs, the key is the use of a secondary combustion process that ensures more complete combustion of the wood, thus increasing the fireplace's operating efficiency to about 50-70%, and reducing the amount of incomplete combustion products and particulates that escape the firebox.

Advanced combustion fireplaces have airtight, gasketed doors, a special ceramic glass window that allows most of the infrared heat from the flame to be transmitted to the room, and a hot air sweep of the window to keep the glass clear. Room air is drawn in through a grille typically under the firebox. From there a blower fan sends it through a heat exchanger and back into the room through grilles at the top of the fireplace. In some units, the heat can also be ducted to adjacent rooms.

Because of their enhanced combustion features, the air requirements for these new fireplaces are low – as little as 14 cubic feet per meter (cfm) (7 L/s) of air from the house to operate properly – which is about the same as that required by high-efficiency gas furnaces. In comparison, this is a fraction of the ventilation required for a typical house.

**Typical Heating System Efficiencies**

| Energy Source | Heating System | Seasonal Efficiency (AFUE) % |
|---|---|---|
| **Wood** | Central furnace | 45-55 |
| | Conventional wood stove (properly located) | 55-70 |
| | "High-tech" stove (properly located) | 70-80 |
| | Advanced combustion fireplace | 50-70 |
| **Oil** | Cast-iron head burner (old furnace) | 60 |
| | Flame-retention head replacement burner | 70-78 |
| | Mid-efficiency furnace | 83-89 |
| | Condensing furnace | 85-95 |
| | Integrated space/domestic hot water mid-efficiency | 83-89 |
| **Natural Gas** | Mid-efficiency | 78-84 |
| | High-efficiency condensing furnace | 89-96 |
| | Integrated space/domestic hot water condensing | 89-96 |
| **Electricity** | Electric baseboards, electric furnace | 100 |
| | Air-source heat pump | 1.7 COP* |
| | Earth-energy system (ground-source heat pump) | 2.6 COP* |
| **Propane** | Mid-efficiency | 79-85 |
| | Condensing | 87-94 |

** COP = Coefficient of Performance, a measure of the heat delivered by a heat pump over the heating season per unit of electricity consumed.*

Today's advanced combustion wood fireplaces have some of the features of gas fireplaces. In areas without access to gas, or with a good supply of wood, they can be an effective heating source for the home.

## Gas Fireplaces

Gas fireplaces are popular for new homes and retrofits. Many different methods have been used to measure the efficiency of gas fireplaces. Some of them can be misleading, so buyer beware.

In Canada, all vented gas fireplaces must now meet the energy efficiency criteria of the CAN/CSA-P.4.1-02 Standard, "Testing Method for Measuring Annual Fireplace Efficiency." Testing to this standard produces a fireplace efficiency (FE) rating which is more accurate than a rating based on peak performance (steady-state) or averaged seasonal rating (annual fuel utilization efficiency – AFUE).

The EnerGuide FE rating is expressed as a percentage. The least efficient units operate in the 30% range, while the most efficient ones are more than 65% efficient. If a gas fireplace is to be used as a secondary heat source, the EnerGuide label can help identify the most efficient models.

The FE rating of the fireplace must be posted either on the EnerGuide label or in the product's technical information when multiple models are listed. The EnerGuide label is not normally placed on a gas fireplace but in promotional materials, such as in sales brochures or on Web sites.

When compared to traditional wood burning fireplaces, gas units offer some benefits as secondary heat sources:

- They are easier to use than traditional wood-burning fireplaces.
- They are convenient, with an on/off switch and a steady fuel supply.
- With a gas fireplace, when the gas supply is shut off, the fire goes out immediately.
- There is no need to clean the hearth, only the glass.
- The home doesn't get the mess – ashes, wood chips, bark, smoke and other residue – that happens with a wood fire.
- Because direct-vent gas fireplaces are sealed combustion units, there is little chance for toxic combustion gases to spill into the home.
- The efficiency is improved because they use no room air.
- When vented to the outdoors, they produce much less carbon monoxide and particulate emissions than wood fireplaces.

## Energy Efficiency Features

Even though a fireplace's EnerGuide FE rating can be a quick reference point for energy efficiency, other features can help determine whether a gas fireplace is energy-efficient. Points to look for include:

- *Direct-vent design – the best option from both a safety and energy efficiency perspective.*
- *An intermittent or automatic electronic ignition system. A standing pilot light to ignite the fireplace can consume as much as half the gas used by the fireplace every year. A fireplace that has an automatic starter, which eliminates the need for a continuous pilot light, is preferred.*
- *A ceramic glass front does a much better job of transmitting infrared heat from the flame to the room than tempered glass. Ceramic glass is also shatter-resistant.*
- *A quiet, squirrel-cage type circulating fan can force convective heat into the room.*
- *A secondary heat exchanger. A well-designed fireplace will have channels around and behind the combustion chamber. A secondary heat exchanger extracts more heat from the combustion gases and transfers it to the house.*
- *The fireplace should never be placed against an uninsulated exterior wall. An insulated outer casing also prevents heat loss through the walls of the home when a fireplace is located on an exterior wall.*
- *Good control capabilities – a variable-setting control or turndown control, will allow the user to adjust the heat output by regulating the rate of gas consumption. For maximum energy efficiency and comfort control, a model should have wide turndown ranges. Some units can be turned down as low as 20 percent of full load. Some models also have an automatic thermostat control to help keep the room temperature at a more constant level by automatically adjusting the firing rate.*
- *Ducting capabilities. Some fireplaces can be connected to a small amount of ductwork – much like a furnace – which can help distribute heat to other areas of the home while preventing overheating of the room where the fireplace is installed.*

R-2000

For information on the R-2000 Program, contact your local program office, or call
1-800-387-2000
www.R-2000.ca

## Wood Combustion: Is It Environmentally Harmful?

Many homeowners use conventional fireplaces and wood stoves because they think this may be less environmentally harmful than heating with oil, gas or electricity, but this is not always the case.

Wood combustion in traditional fireplaces and poorly designed wood stoves can result in high levels of emissions, contributing to air pollution problems outside the home, as well as to indoor air quality problems.

However, wood differs from fossil fuels such as oil and gas because it is a renewable fuel. As a tree grows, it absorbs carbon dioxide from the air and stores it in the wood as carbon. The carbon makes up about half the weight of wood. When wood is burned, carbon dioxide is released again to the atmosphere, but the same amount of carbon dioxide would be released if the tree died and was left to rot. New tree growth then reabsorbs the carbon, so forests can be a perpetual source of fuel provided they are cared for and managed properly.

While wood combustion can be environmentally neutral if it is managed properly, it is still most environmentally appropriate to reduce the amount of heat required by a building in the first place.☼

# Effectiveness of Dehumidifiers in Controlling Moisture in Houses

There are numerous moisture sources that impact a house, including precipitation, surface water, ground water around the foundation and moisture generated inside the house by occupants. If there is enough moisture, it can accumulate, and if there are cold surfaces it can lead to condensation, water damage and mould growth.

A variety of strategies can be used to deflect, drain and dry outdoor moisture and to control indoor moisture sources.

Dehumidifiers are often used as temporary solutions to high indoor humidity conditions that may occur throughout the year. Although year-round operation of dehumidifiers may offer improved moisture control, the extent to which this is the case had not been fully explored.

A CMHC study looked at the effectiveness of typical residential humidifiers with the aim of developing a practical and cost-effective method for assessing the effectiveness of dehumidifiers in controlling moisture in houses in different regions of Canada. The study examined the effectiveness of a typical residential dehumidifier in reducing moisture levels in basements of new houses.

The study examined moisture conditions in houses across Canada with and without dehumidifiers over a period of two years. Study houses selected did not have dehumidifiers or air conditioning systems, had not experienced previous flooding in the year before, and were not expected to undergo renovations in the next two years.

Wood moisture content was measured at five pre-determined locations in the basements and two locations on the upper floors. An infrared thermometer was used to measure surface temperatures in five basement and seven main and upper floor locations.

Moisture conditions of each house without dehumidifiers were monitored the first year, after which dehumidifiers were installed and moisture conditions monitored for another year. When the dehumidifiers were operating, the volume of water extracted by the dehumidifier was measured.

The dehumidifier chosen for the study was a heavy-duty model with a moisture-removal capacity of 31L (8.19 gal.) per day and a 10 L (2.64 gal.) reservoir for the removed water. It had automatic controls that started it when the ambient air RH exceeded 50%, and stopped operation when the ambient air reached the pre-set RH of 50%. The dehumidifier also stopped operating when the reservoir was full.

Although there were gaps in moisture meter measurements and volume of water reported due to reporting lapses or absences on the part of some occupants, the overall quality of the data from the 18 houses was sufficient for analysis.

In the first year, without the dehumidifiers, the indoor air absolute humidity during the winter months was higher indoors than outdoors. During warm months, from May to the beginning of October, indoor absolute humidity resembled that of outside air, with a peak in early August. In the second year, when the dehumidifier was running, indoor absolute humidity remained nearly constant and lower than the outdoor absolute humidity during the warm months from May to October

On the main floor, which is typically open to the outdoors during the warm months, there was no reduction of indoor air moisture levels during the second year when the dehumidifier was operating. Generally, moisture levels in basement air were less than moisture levels in outdoor air during the spring, summer and fall months when the dehumidifier was operating.

Dehumidification of the basement lowers the absolute indoor humidity and this is reflected in the wood moisture content in the basement.

Without dehumidification, the wood moisture content peaked at 10 per cent between June and October, while in the second year, with dehumidification, the wood moisture content stayed around 7 to 8 per cent. There was no difference in moisture content of wood between the first and second year on the upper floor, which is consistent with the observation showing the limited impact of dehumidifier operation on the main floor indoor air moisture levels.

In one house, the absolute humidity was lower with dehumidification but the wood moisture content was high, with 7 to 12 per cent moisture content in the summer and up to 24 per cent in the winter of both years. The moisture removal rate was as high as 0.75 L (0.20 gal.)/hr. This was attributed to an attached crawlspace with a dirt floor in one house, and a preserved wood foundation in the second. Dehumidifiers could not make a difference to the moisture loading through the dirt floor and moisture may be diffusing through the wood foundation of the second house.

Overall, more than half the houses tested showed a reduction in indoor humidity levels when dehumidifiers were installed relative to the corresponding climatic conditions of the regions where these houses were located. The highest moisture removal rates were in Atlantic Canada. The Prairies (considered 'dry' in the winter, not needing dehumidification) had high moisture removal rates during the summer. In central Canada, moisture removal rates were low to medium in the summer. In BC, the moisture removal rate was low to medium year round.

This study confirmed that dehumidifiers were effective in reducing indoor humidity and in the wood of basements during the warm months – May to November in most regions of Canada. Moisture levels in basement air were less than moisture levels in outdoor air when the dehumidifiers were operating.

In most regions of Canada, dehumidification is beneficial during the non-heating season while year-round operation can be beneficial for houses located in milder coastal climates. Basements of new homes can be dehumidified, even before occupancy, to help remove construction moisture.

While mechanical dehumidification does work, source control of moisture should be considered first. In new construction this should be easy to do if proper site planning and detailing is followed. In the case of retrofits, where it is practical and cost-effective, moisture management should be considered first, especially since the energy costs associated with the operation of dehumidification equipment can be high. ☼

*Effectiveness of Dehumidifiers in Controlling Moisture in Houses by Buchan, Lawton, Parent Ltd. for CMHC.*

# Celebrating Excellence in Wood Structures

The wood industry has a long tradition of providing technical and design support to the design and construction industry. Their annual North America-wide Wood Design Awards recognize and celebrate design achievements in wood use in all building types.

The winners of all the 2008 North American Wood Design Awards have been published in a very attractive book. In addition to highlighting the winners of the North American 2008 Wood Design & Building Awards, this year's annual awards book also features the frontrunners from the Canadian Wood WORKS! Awards (including British Columbia and Ontario), and the US WoodWorks Wood Design Awards (including California, the Southeast and the North-central).

The 43 featured projects show a wide range of wood product applications and demonstrate an understanding and passion for the special qualities of wood.

This attractive, full-colour, hardcover book with over 200 pages, is more than just an attractive coffee table book. Builders and designers will delight in the attractive and creative uses of wood celebrated in the highlighted projects.

*Celebrating Excellence in Wood Structures* available from the Canadian Wood Council, $34.95 *www.cwc.ca*

# Forced Warm Air Heating System Pressure Balancing

Homes with forced air heating and cooling systems are designed to circulate an equal volume of supply and return air through the system, keeping air pressure throughout the building neutral. Each conditioned space in the building should, ideally, be at neutral air pressure at all times – each room should have a supply and exhaust supply to move equal volumes of air.

Typical system design places supply registers in rooms to be heated, and return air grilles in a common area like a hallway or staircase. The common practice is to undercut interior doors to allow for the air flow circulation. However, that full balanced airflow does not always happen, especially when bedroom doors are kept closed. Often the gap under the door just doesn't allow enough air movement.

When return air flow is restricted by closed doors it creates pressure differences between rooms in the house. When a room is under a positive air pressure, indoor air will be pushed outward, which can also lead to moisture problems because exfiltrating air carries moisture with it. When a space is under a negative pressure, air will be pulled inward through the walls, floor and ceiling, or more seriously, through combustion appliance flues.

Although door undercuts may be a critical part of a forced warm air heating system design, they are not within the scope of work of the heating contractor. Rather, it is under the builder's control, so that the actual dimensions are greatly affected by the thickness of the floor coverings and trims that homeowners may add.

Positively or negatively pressurized rooms affect the proper distribution of heated and cooled air in the house, and ventilation air distribution, especially when ventilation air distribution is combined with the forced warm air heating. Pressure differences within the house thus can severely impact indoor air quality in the house, as air flow seeks the path of least resistance – down open combustion flues, through the walls, floor and ceiling, from unconditioned spaces or the outside environment – to make up for the trapped air in the closed room.

*A rule of thumb for sizing a door undercut is that the area of the undercut doubled provides the cubic feet per minute of air that will move at a pressure difference of 2.5 pascals.*
*[ area (sq.in.) = cfm]*

Some codes set the maximum pressure imbalances allowed in closed rooms at 0.01" WG or 2.5 pascals when compared to the main portion of the building where the return is located. Research in Florida quantified the impact of closed doors, pressure imbalance in rooms, and the volume of air flow through undercut doors. Room pressures with respect to the main body of the house of 7 pascals or more were measured.

Pressure imbalances within a house can be prevented by installing a fully ducted return system, by creating passive return air pathways such as louvered transoms, door undercuts, "jump ducts", through-wall grilles, or baffled through-wall grilles.

A "jump duct" is a piece of flex duct attached to a ceiling register in the closed room and another ceiling register in the main body of the house. A jump duct provides some noise control while providing a clear air flow path.

A through-wall grille is the simplest approach to provide pressure relief for closed rooms. Holes opposite each other on either side of the wall within the same stud bay are covered with return air grilles. However, this severely compromises the privacy of the closed room unless one of the grilles is placed high on the wall on one side, and low on the opposite wall.

Another way is to connect the two openings with a sleeve of rigid ducting that is acoustically treated to minimize visual and sound privacy issues. Tamarack Technologies developed a sleeve with a baffle that can reduce the transfer of light and sound but still provide air flow to minimize pressure differences. The product is called Return Air Path and allows the movement of air from one room to the next, equalizing pressure in the home while dampening sound and light from one room to the next. It can be easily installed in retrofit applications.

The amount of air that will move through a grille, jump duct, door undercut, or offset grille depends on the size and geometry of the opening, and their resistance. The table shows the air flow through different types of openings when the pressure difference is 2.5 pascals.

It is important to realize that a typical forced warm air grill is designed to deliver about 40-50 cfm of air. When more heat is needed, as in a larger room with larger heat loses, more registers are installed into the room to deliver the larger volume of warm air, rather than trying to force larger volumes of air which could lead to noise and discomfort due to drafts. For a balanced air flow, the return will also need to be larger. ☼

**Airflow through various opening configurations**

| Opening configuration | Dimensions | Area* | 2.5 Pa | 5 Pa |
|---|---|---|---|---|
| Undercut door | 1" x 30 | 30 sq.in. | 62 cfm | 90 cfm |
| Jumper duct | 6" diameter | 28 sq.in. | 36 cfm | 52 cfm |
| Wall cavity (offset grille) | 4"x12" | 48 sq.in. | 41 cfm | 60 cfm |
| Wall sleeve | 4"x12" | 48 sq.in. | 42 cfm | 61 cfm |
| Wall sleeve | 12"x6" | 72 sq.in. | 60 cfm | 88 cfm |
| Wall sleeve | 12"x12" | 144 sq.in. | 120 cfm | 169 cfm |
| Jumper duct | 8" diameter | 50 sq.in. | 62 cfm | 90 cfm |

* *Nominal opening area – actual open area for grilles will vary depending on screen and louver design, which can reduce effective open area.*

*Table presents maximum air flow achievable using various return air paths from closed rooms at a room pressure of 2.5 pa or 0.1" wc with respect to the return zone. For example, a 1" door undercut could be used to maintain 2.5 Pa in rooms with supply air up to 62 cfm.*
*Larger pressure differential will be able to push more air, but it also can mean more noise due to moving air, as well as contributing to envelope problems.*

Return Air Pathway Study by the Florida Solar Energy Centre.
*www.baip.org/casestud/return_air*

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Canadian Home Builders' Association

# Technical Research Committee News

## Product standards

Concerns have been expressed that, with the introduction of new materials, which have come with new product standards that get referenced in the building code, traditional materials that have a proven track record are being questioned. In part, this is happening when some building officials read the code, and start looking for referenced products over traditional materials, even in cases where some traditional materials have no testing, but have proven themselves over many years.

This came to light in Nova Scotia, where traditional building paper used as the weather barrier over the sheathing is being questioned.

In British Columbia, where the local building department is the authority that has jurisdiction over code interpretation, some cities are ignoring the basic objectives of the code and insisting on use of only 'certified' products, even for materials that are not covered by any type of standard and for which there is no certification. This is especially the case with new rain screen products (the code only requires that the rain screen be defined, but does not specify how it must be defined).

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.
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www.chba.ca

## Regulatory issues for new technologies.

The Equilibrium projects are pushing technological limits in many home systems. Not surprisingly, the teams have encountered some regulatory barriers. As part of the ongoing monitoring and evaluation of lessons learned, CMHC will be investigating the barriers that these projects have been encountering.

Two new technologies that have attracted interest, and a lot of regulatory obstacles, are grey water use, and rain water harvesting for household use.

## Chinese drywall

Drywall used in the US that originated in China has received much attention and media coverage in some quarters because of problems encountered recently. The US Gypsum Association has noted that a small amount of Chinese product was imported to the US between 2005 and 2007 and the full nature of the problem has not been identified yet. It seems that the problematic product originated in only one part of China. None was spotted with counterfeit labels.

The indication of problems is unpleasant "rotten egg" odours, which is also contributing to corrosion of metals.

Gypsum is a common mineral that over time can dissolve in water. Chemically it is composed of calcium sulfate, which explains why odour of degrading gypsum resembles that of rotten eggs.

The industry points out that this is one case where the drywall was imported not to circumvent standards or because of low price, as there was little advantage to the importers because drywall is a heavy, bulky, relatively low cost material. The drywall was imported simply because of material shortages in North America, so it was filling a market demand at the time.

However, it does reinforce the importance of verifying the provenance of materials, and their certification.

This problem could also be an indicator of high humidity levels and potential moisture problems in the houses. In the absence of moisture, there should be little deterioration of the gypsum board, which leads to the rotten egg smells.

## Energy Efficiency in Codes

The National Building Code has had at its core four major objectives – safety, health, accessibility for persons with disabilities, and fire and structural protection of buildings. Thus every code requirement has a link to at least one of these objectives.

Changing public expectations have increased the pressure to expand code objectives to include energy efficiency and water conservation. Some provinces now include these objectives in the code. In order to facilitate the harmonization of standards across the country, the National Building Code is now introducing into the code's objectives.

Although it will not appear in the 2010 cycle of the code changes, work is underway to prepare energy efficiency standards. These will be based on a revised and updated Model National Energy Code for Houses (MNECH) with the intent of publication of the technical standards in 2012.

## Changes to Canadian Furnace Standards

New national minimum energy performance standards for gas furnaces go into effect January 1, 2010. As of that date, gas furnaces for most residential applications must have a minimum fuel efficiency level of 90%. This level of efficiency is achieved through high efficiency "condensing technology" where the products of combustion are exhausted from the living area by a plastic vent pipe. Although this vent pipe can be routed through the side-wall, to avoid building envelope problems the venting should be taken through the roof.

# Ventilation Equipment

North American home building technology has changed much in the last generation. Homes are much more sophisticated today. Along with that, the components used in homes need to be more sophisticated. As well, with more energy efficient, air-tight home construction, movement of air becomes more critical.

New products are showing up on the market that can effectively address the needs of modern construction.

Tamarack Technologies, Inc., a Massachusetts-based company, has developed a range of energy efficient ventilation products that can help improve the home environment. They manufacture whole house fans, indoor air exchange products and electronic controls. These products offer effective solutions for older homes.

### Whole house fans

The Dream Aire 5000 is a wall-mounted reversible fan and filter unit. It delivers tempered, filtered air into the home, then reverses and removes air from the home in 30-second cycles that can be programmed to operate for 4, 8 or 12-hours per day. It has a single exterior/interior port, and can be used in smaller dwellings. The unit has a re-usable electrostatic precipitation filter and features a two-speed fan motor that uses 15 watts to deliver 30 or 50 cfm of air. The heater is 200 watts.

This is a unit that provides an option for retrofitting air change into smaller older homes and for apartments where there is no ductwork.

### Garage Fans

The attached garage is a source of contaminants in many homes. Although the separation between the garage and house is supposed to be airtight, in reality it rarely is because of the many service penetrations through the common elements. One way to flush out contaminants is to have an exhaust fan to remove air after the vehicle has been moved.

The Dragon Garage Fan by Tamarack is a quiet, energy efficient fan designed for easy through the wall installation. It exhausts hot, humid, toxic air from the attached garage to remove gasoline, fertilizer, paints, pesticides and auto exhaust fumes.

The unit features a powerful external rotor motor plus a built-in spring-loaded backdraft damper to prevent insects from entering the garage. It is available in three sizes, from 100 to 360 cfm.

### Backdraft Dampers

Ducted systems need to be designed so that proper airflow is provided where it is needed. This usually requires some dampers to balance the airflow, and prevent backflow. The most common way this is done is with metal butterfly or gravity dampers. Tamarack has developed a fabric backdraft damper that is a silent, in-line maintenance free valve that allows air flow in one direction in cold and hot streams and is tested to UL723 standards. It is designed to overcome the inefficiencies and limitations of traditional gravity or butterfly dampers.

The Cape Backdraft Damper consists of a specially formulated fabric sleeve attached to an outer metal sleeve. The fabric sleeve will allow air to pass through in the desired direction of flow with miniscule reduction in airflow. It can be installed in horizontal or vertical ductwork.

Tamarack Technologies Inc.
Tel: 1-800-222-5932
*www.tamtech.com*

# You Asked Us: About Temperature Stratification

*Is there a way to bring heat down from the ceiling, in this case, in a sauna? The temperature difference from the floor to the ceiling is about 40 degrees Celsius. Would a ceiling fan blowing down work? Since you would be moving air this way it would also cool it down which is not what we want. Is there any other way?*

This is an interesting question. Ceilings fans do play an important part in helping redistribute heat in a space. In high ceilinged commercial buildings such as warehouses, shops and retail stores, one often sees ceiling fans for precisely this reason. Ceiling fans are often used in homes with high vaulted ceilings for the same reason.

In tropical climates ceiling fans are used to generate airflow as a cooling strategy.

Temperature stratification is an indication of heat loss. In a home, high temperature stratification is an indication of large volumes of air leakage near the upper portions of the house. As the buoyant warm air rises, and as it escapes through the upper portions of the building, it is replaced with colder, denser air at the lower portions of the house. In an airtight house, there is less air leakage, and depending on how the leakage areas are distributed, much less stratification of temperatures. And of course, the house will also be more comfortable as well as more energy efficient.

You may want to have some stratification of temperatures in a sauna, which is why saunas have tiered benches - so that if it's too hot on the top bench, you can sit on the lower bench. But in a sauna you want to maintain high temperatures – in the range of 60-80°C.

If you are seeing a 40°C temperature difference, it is an indication that the sauna cabin is not particularly airtight, and you may be loosing a lot of heat through air leakage to the surroundings. Ed.



# Residential Indoor Air Quality Guidelines: Mould

## Physical and chemical properties

"Mould" is a common term referring to fungi that can grow on building materials. Mould growth can influence air quality because both spores and mycelial fragments are dispersed into the air and can be inhaled. Their penetration into the lungs depends on their size – smaller particles penetrate deeper.

Three features of mould biochemistry are of special interest in terms of human health:

- mould cell walls contain a compound with inflammatory properties;
- mould spores and mycelial fragments contain allergens; and
- the spores of some species contain chemicals that have toxic properties.

## Causes of mould growth

Mould growth in a house requires the presence of nutrients, an appropriate temperature, and a supply of water. Because the first two requirements are usually readily available indoors, fungal growth usually results from a moisture problem. Major causes of mould growth are:

- condensation of moisture on surfaces due to excessive humidity, lack of ventilation, or low temperature;
- water leaks, (e.g. from a broken pipe);
- infiltration of water from the outside (e.g. a leaking roof or a cracked basement); and
- a flood.

Health Canada and the Institut national de santé publique du Québec have carried out reviews of the scientific literature related to the health effects of indoor moulds, and have drawn the following conclusions:

- Exposure to indoor mould is associated with an increased prevalence of asthma-related symptoms such as chronic wheezing, irritation symptoms, and non-specific symptoms; and
- In laboratory animal studies, instillation of fungal antigens (*Penicillium sp.* and *Aspergillus sp.*) and fungal cell components [*(1->3)-β-D-glucan*] resulted in an inflammatory response in the lungs of rodents, while instillation of *Stachybotrys chartarumspores* resulted in severe histological and biochemical changes.

These conclusions have been supported by more recent findings where significant associations were found between home dampness and the risk of developing asthma. In experimental studies, asthma-like responses were observed in mice following exposure to a typical building-associated fungus (Penicillium chrysogenum), and inflammatory responses were seen in rats exposed to low doses of toxins from the same species.

*It isn't necessary know what kind of mould is growing before making a plan to remove it*

## Testing for Mould

The first thing that comes to people's minds when they suspect mould is to have the air of the house tested. This involves collecting an air sample and sending the sample to a laboratory for analysis. However, the large number of mould species and strains growing in buildings and the large variability in human response to mould exposure means that it is not possible to establish precise exposure limits.

Air sampling alone provides no information about health risk. Decisions cannot be made based on the laboratory results. If there are strong indications that mould is growing in the house, intrusive checking may be needed to find the mould.

Canada Mortgage and Housing Corporation (CMHC), the US Environmental Protection Agency (EPA) and the American Industrial Hygiene Association do not recommend testing the air for moulds in single-family dwellings and similar buildings as a first step.

If there is a concern about the presence of mould in a home that is causing health problems, it is possible for a homeowner to do a preliminary examination of their home. CMHC has two

publications – The Clean Air Guide and Clean-up Procedures for Mould in Houses that include easy to use checklists.

It isn't necessary know what kind of mould is growing before making a plan to remove it. The solution is the same whether the mould is a toxic mould or a common type of mould.

If the problem in not easy to locate, or the owner remains unsure, they may want to hire a professional to help. The recommended first step is having a trained investigator check your house for mould. A trained investigator may then advise mould testing after inspecting the house when:

- they can't find the mould because it is hidden (for example, in a wall, in the attic or in the crawl space), or;
- they find mould but aren't sure if it is affecting the family's health.

Removing mould must be done carefully under controlled conditions. For information about removing mould, go the Health Canada website and enter "mould" in the search box.

*Health Canada: Residential Indoor Air Quality Guidelines – Moulds*

The most important point about removing mould is to fix the underlying moisture problem.

## Health Canada Guideline

Health Canada considers that mould growth in residential buildings may pose a health hazard. Health risks depend on exposure and, for asthma symptoms, on allergic sensitization. Therefore, Health Canada recommends:

- to control humidity and diligently repair any water damage in residences to prevent mould growth; and
- to clean thoroughly any visible or concealed mould growing in residential buildings.

These recommendations apply regardless of the mould species found to be growing in the building. Further, in the absence of exposure limits, results from tests for the presence of fungi in air cannot be used to assess risks to the health of building occupants. ☼

# Energy Answers

*Rob Dumont*

*Is there any way to fix a sealed window in which the seal has failed and moisture has entered the window?*

Yes. I recently had a professional come by and fix three sealed windows that were badly clouded by moisture. The windows were triple-glazed and they were not tempered glass.

The windows were on a rental house built in 1986, and the tenants asked if the windows could be fixed.

The repairman started by drilling two holes about a quarter inch in diameter (6 mm) through the outer piece of glass. The holes were located in the lower left and upper right parts of the glass. In Canada's climate, it is very important to drill from the outside, as the air outside is typically drier than the air inside a house. If you drill from the inside, the moisture from inside the house will soon cloud the window again. He then used a hand sprayer to inject a cleaning solution into the window through the lower hole. The cleaning solution washed off the film on the inside of the glass. He then left the house and let the cleaning solution dry out for about two weeks. After two weeks, when the window was dried out, he came back and put two small filters in the holes in each window. The filters keep dust and bugs from entering.

The results were impressive. The cloudy appearance of the window disappeared and the tenants were satisfied. The price for the repairs was about one-third the price of installing new sealed units. In addition, the existing windows were salvaged instead of having been carted to the landfill.

On Jon Eakes web site (*http://joneakes.com/cgi-bin/getdetailscals.cgi?id=1079*) there are instructions for do-it-yourselfers, including information and pictures on the special Lee Valley Tools bit that can cut through glass.

*What is your opinion of the **LEED for Homes** program?*

LEED stands for *Leadership in Energy and Environmental Design*, a program started by the US Green Building Council. The Canadian Green Building Council administers the program here in Canada.

LEED has rating systems for New Construction (of larger buildings), Commercial Interiors, Core and Shell (commercial buildings where the tenant is not known in advance), Existing Buildings, Homes, and Neighbourhood Development.

On the *LEED for Homes* program, they have the following categories for which credits can be gathered:

Innovation and Design Processes
Location and Linkages
Sustainable Sites
Water Efficiency
Energy and Atmosphere
Materials and Resources
Indoor Environmental Quality
Awareness and Education

These 8 categories are all worthy ones. I do not think, however, that sufficient attention is paid to energy use. For instance, an Energuide rating of 76, well below the current R-2000 standard of about Energuide 80, is acceptable for a minimum LEED certification.

I am generally supportive of the LEED endeavours, but am greatly concerned about the cost and complexity involved. Homebuilding is a very competitive business. The cost and complexity of the rating scheme as now constituted will greatly impede the uptake of the LEED process.

I have spoken with two home builders who are in the LEED certification process, and both are very concerned about the cost, the complexity and the time required to go through the certification process. The manual for the Canadian LEED for Homes program is 151 pages long. 151 pages!

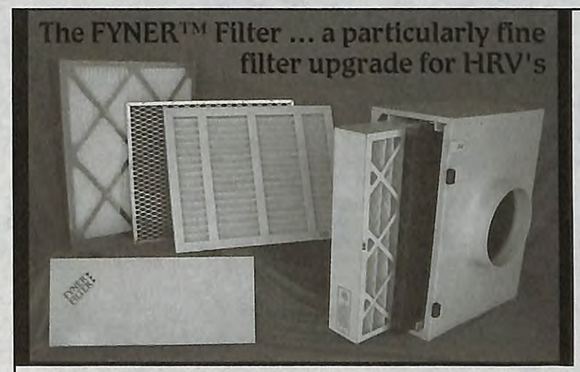
Recently a major review of critiques of the LEED system was conducted. The article is available on the web at *www.greenrealestatelaw.com*

One of the strongest critics put it this way: "The LEED system is not only ineffective, but is harmful to the environment, to the prosperity of the country, and to effective energy saving methods, which are ignored in favor of the image of energy efficiency. LEED should be abandoned and be replaced with a system that is based on actual verifiable energy use measurements."

I don't agree with abandoning LEED. However, I do have major criticisms about the LEED for Homes process. Here they are:

1. LEED certification is too costly.
2. The documentation required is far in excess of what is needed. A one page checkoff sheet should be sufficient.
3. Energy use is not sufficiently targeted.
4. The lag time to go from application to certification is far too long.

LEED has put forth aggressive targets for getting a large number of homes certified in the coming years. Without a major change in the certification process, however, LEED for Homes will be dead. ☼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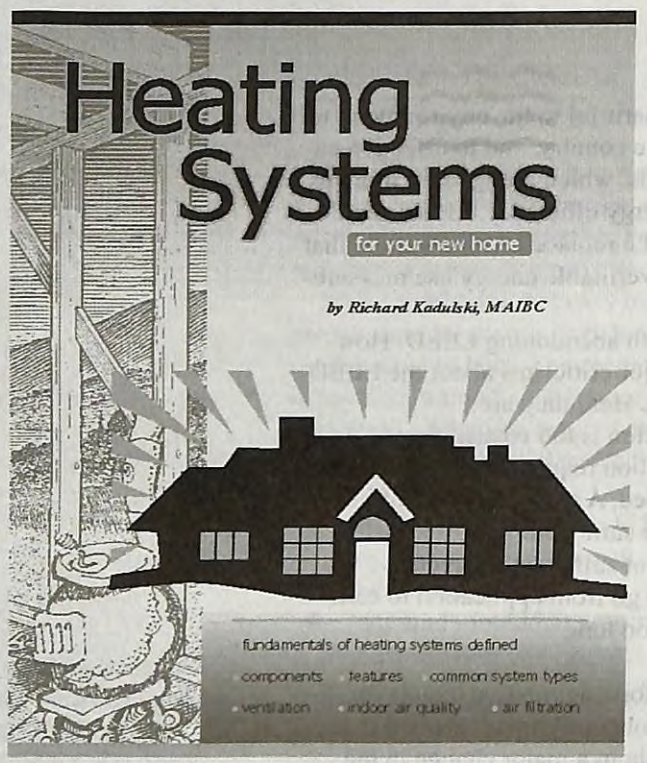


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